

Measuring Iron in the Liver

How a simple yet critical metric can turn the tide for the diagnosis and management of iron overload

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Introduction

Most people think of iron as something they *want* in their bodies and may also fear that they may be deficient in it. But as a physician with over 30 years of internal medicine and hepatology experience, I know that approximately [one million Americans](#) suffer from the opposite — *too much iron, which can wreak havoc on the body*.

What can cause iron overload in the body?

- Hereditary hemochromatosis is a genetic disease that disrupts the body's ability to regulate iron absorption, making it absorb too much iron from the diet.
- Iron overload can also occur in individuals without hemochromatosis. Several chronic liver diseases (e.g., alcohol-induced fatty liver disease, nonalcoholic fatty liver disease [NAFLD], etc.) can disrupt iron homeostasis.

What are the effects of iron overload in the body?

- Iron overload is a systemic disease — it hurts everything it touches, including the pancreas, joints, and the heart, paving the way for the development of chronic diseases such as diabetes, arthritis, and heart failure.
- Iron buildup particularly affects one organ in the body — the *liver*. *Excess iron in the liver can cause scarring of the liver (cirrhosis) in up to 70% of patients with hemochromatosis, and these patients have a high likelihood of developing liver cancer or needing a liver transplant.* The risk of progression to cirrhosis or cancer is even higher in patients who also have fatty liver disease or hepatitis.

How is iron overload assessed in the liver?

Hepatologists performing standard assessments of patients with liver disease (e.g., NAFLD) will order further tests if they identify high iron saturation on a total iron-binding capacity blood test, a test that is much better than ferritin for screening for iron dysmetabolism. However, *accurately quantifying iron in the liver is just as important (if not more) and can be complicated*. Some commonly used tests to assess iron overload in the liver include:

- **Serum transferrin saturation test:** It is a blood test that measures the amount of iron bound to transferrin, a protein that carries iron in your blood (transferrin saturation values greater than 45% are considered too high). If your serum transferrin levels are higher than normal (> 45%), your doctor may want to check your serum ferritin. However, several other conditions can also cause elevated ferritin, and you may need repeated tests to get accurate results.

- **Liver biopsy:** It is an invasive method of assessing iron overload in the liver. This procedure only assesses a tiny fraction of the liver, and it is very possible to get erroneous results. Through my years of practicing hepatology, I've wondered over and over, "*What if we could look at the whole liver noninvasively?*" I've long believed this could revolutionize the diagnosis of iron overload in the liver for patients without the need for a relatively risky, painful, costly, and error-prone invasive procedure like a liver biopsy. I am pleased that I don't need to wonder about this prospect anymore, because it is now possible to noninvasively quantify liver iron concentration with MRI technology.

How is liver iron content noninvasively quantified with MRI technology?

- Perspectum's LiverMultiScan[®], a noninvasive, MRI-based liver tissue characterization tool, provides metrics related to three liver tissue characteristics: inflammation, fat, and iron. This FDA-cleared and reimbursed scan provides rapid, accurate, and reproducible information of interest for my patients.
- Physicians appreciate the visual, clinically meaningful report that LiverMultiScan provides. Variation in biomarker values is provided on intuitive scales, simplifying the process of explaining test results to patients and encouraging productive discussions about treatment options between clinicians and patients.
- The metric provided by LiverMultiScan on iron (*liver iron concentration or LIC*) is expressed in milligrams of iron per gram of dry weight liver tissue (mg Fe/g dw). *This accurate metric aids and simplifies the diagnosis and monitoring by streamlining iron measurement.*
- LiverMultiScan's LIC metric may be particularly beneficial for patients with renal failure who have iron overload. As these patients often can't undergo phlebotomy treatment, they are treated with an oral chelation medication, which allows their bodies to eliminate iron through the stool. These patients need monitoring to make sure too much iron is not being removed, which can cause severe anemia not responsive to treatment. As measuring treatment response (iron reduction) using iron saturation and ferritin can be very hard in these patients, LiverMultiScan can greatly help this patient group.

Conclusion

When it comes to adopting new diagnostic technologies offered to physicians, accuracy and simplicity are the two critical aspects we consider.

- Physicians need tools that allow them to make informed decisions as simply as possible. Tests that are too difficult to access or interpret will inevitably fail. In my years of experience, I've watched a growing graveyard of companies that didn't get this aspect of MedTech right.
- LiverMultiScan's new update is offering LIC, and now physicians can see a simple data output — a single value that accurately indicates liver iron quantity for direct treatment planning. This is the simplicity and accuracy the medical community has been awaiting.

To learn more, visit perspectum.com/products/livermultiscan.

Disclaimer: I am a medical consultant for Perspectum. See [RobertGish.com](https://robertgish.com) for other disclosures.

A patient with high liver cT1, mildly elevated fat fraction, and high liver iron concentration (LIC) elevation

LiverMultiScan

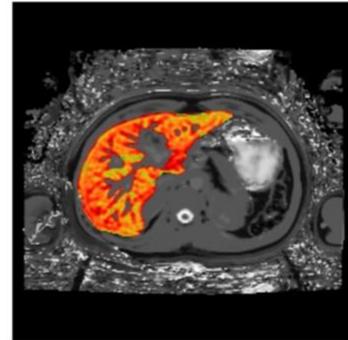
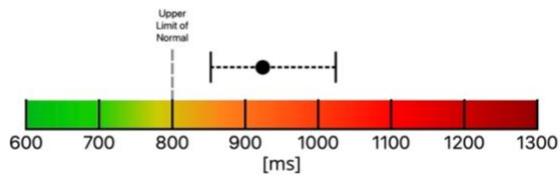
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Patient ID:	3725181	Birth date:	1970-Jan-01
Sex:	Male	Referring clinician:	Anonymised

Liver cT1: 924 ms

(Range of Values Detected: 853 to 1024 ms)

(Upper Limit of Normal: 800 ms)

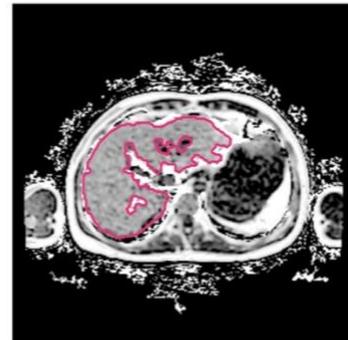
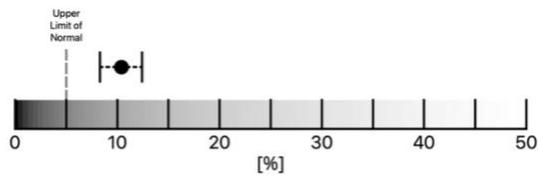
Correlates with fibroinflammatory disease activity^{ABC}



PDFF - Liver Fat Fraction: 10%

(Range of Values Detected: 8% to 12%)

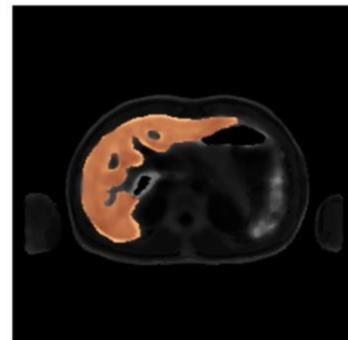
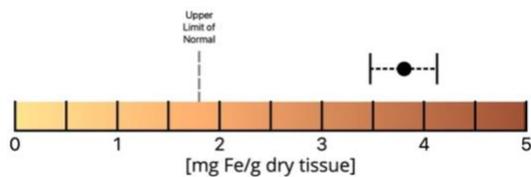
(Upper Limit of Normal: 5%^{AD})



Liver Iron Concentration: 3.8 mg Fe/g dry tissue^E

(Range of Values Detected: 3.5 to 4.1 mg Fe/g)

(Upper Limit of Normal: 1.8 mg Fe/g)



Cross-hatched areas do not contribute to summary metrics shown. For a detailed description of LiverMultiScan please refer to "A Guide to Interpreting Liver Tissue Characterization for Clinicians" available from Perspectum, info@perspectum.com